Carnegie Mellon University

Asbestos Pipe-Insulation Removal System

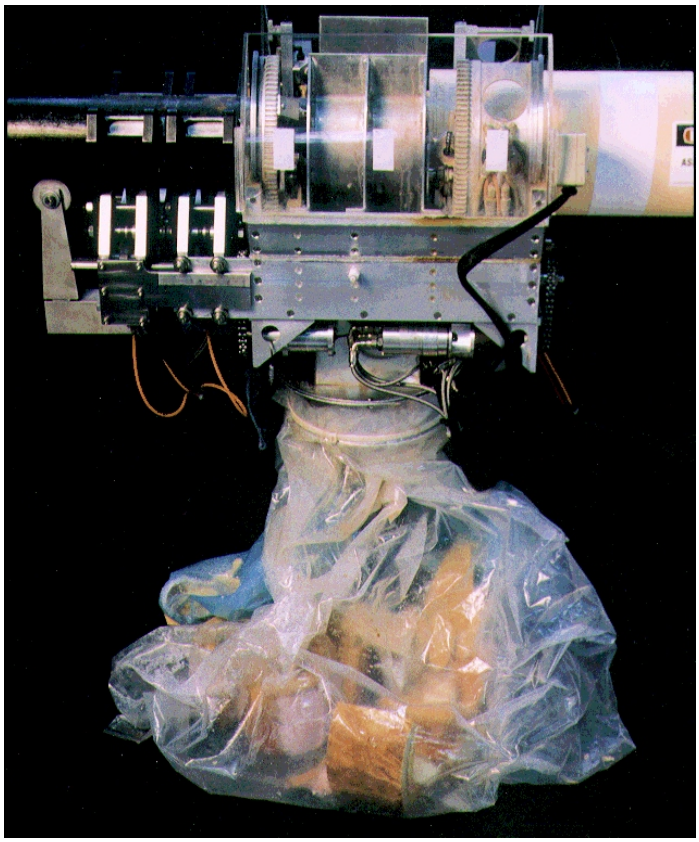
Technology Need:

Most of the steam and process piping in Department of Energy (DOE) facilities is clad and insulated with asbestos-containing materials (ACM), which must be removed before any decontamination and decommissioning (D&D) activity. Manual removal is expensive and time consuming because of the carcinogenic nature of asbestos fibers, radiological contamination, and abatement regulations from the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA). Current manual methods require substantial infrastructure for scaffolding, containment areas, and air monitoring, which results in low asbestos-removal rates.

Technology Description:

Carnegie Mellon University (CMU) has developed a mechanical asbestos-removal system, dubbed BOA for "Big on Asbestos". BOA can be remotely placed on the outside of the pipe and can crawl along the pipe, wetting the ACM, encapsulating and stripping the pipe, and bagging the removed insulation. Careful attention to vacuum and entrapment air flow ensures that the system can operate without a containment area while meeting local and Federal standards for fiber-count.

The general configuration of the BOA system is that of an on-pipe self-locomoting removal head with an off-pipe control and handling system tethered to an off-board HEPA vacuum and liquids supply system. The removed insulation is vacuumed into a stationary HEPA vacuum system and manually bagged at the separator. The removal head can be placed on pipes using a mobile boom-vehicle, allowing the system to work on pipes from 8 feet to 60 feet above ground. BOA can travel on pipe of 3 to 4 inches in diameter; crawls past hangers unassisted; is helped around obstacles such as valves; cuts through various types of insulation cladding, such as plaster-tape, aluminum lagging, wire-mesh, plastic boots and pipe-clamps; adapts to inconsistent insulation thickness; and reduces fiber emissions to allowable level while feeding removed ACM and lagging into a vacuum-fed bagging and waste water separator system.



BOA Asbestos Pipe-Insulation Removal System

Lagging and insulation are cut using a hybrid endmill and water-jet cutter, and diced into 2-inch cube sections of ACM. These are removed from the pipe using a set of blasting fan-spray nozzles, and vacuumed off through the vacuum hose.

Asbestos fibers are contained by drawing a vacuum on the entire removal module using the off-board HEPA vacuum. A separate fluid system provides sealant to

spray the stripped pipe with an encapsulant material. Sensing on the removal head to detect and avoid obstacles consists of a hall-effect sensor, an infrared light-curtain and a set of bump switches.

The removed insulation sections are transported to the HEPA system where the waste and water are separated and the ACM is bagged using standard techniques. The water is recycled for continued use in the abatement. The bagged insulation can be taken to a disposal site for further treated.

Benefits:

- Asbestos removal from pipe sizes from 4 to 8 inches in diameter
- Increased asbestos-removal rates
- Fully contained and sealed operations
- Provides continuous asbestos removal and packaging for easy processing and disposal

Status and Accomplishments:

The first field demonstration of the BOA system was completed in August 1997 at the East Tennessee Technology Park, the former Oak Ridge K-25 Site. In the demonstration, controlled solely by local operators trained in the previous week, the system abated a 20-ft section of 4-in pipe in about 45 minutes, including simple paper and mast-coated CalSil insulation with wires, passing a hanger unaided as well as removing a section of aluminum-lagged, screwed-in, wired, and banded section of insulation.

A second demonstration of BOA was held at the Department of Defense's Pentagon Building in Arlington, Virginia during July 1999. The demonstration was performed initially on a mockup pipe and the asbestos insulation was removed successfully. However, on the actual asbestos covered pipe, BOA worked initially and then failed because of the heavy canvas covering of the pipe. The crawler was jammed and when this happened, the water which was running continuously caused motor damage.

The assessment from this demonstration concluded that the system performs well on asbestos but was not designed for the canvas wrapping of the asbestos insulated pipe.

The BOA technology placed second in a national design competition hosted by the renowned Design News trade journal/magazine. BOA was selected from a large number of national entries and was judged to be one of the most innovative new designs and products in the United States in 1997/1998. BOA was also recognized for a DOE Energy 100 Award.

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Online Resources:

Office of Science and Technology, Technology Management System (TMS), Tech ID # 148
http://ost.em.doe.gov/tms

The National Energy Technology Laboratory Internet address is **http://www.netl.doe.gov**

For additional information, please visit the Carnegie Mellon University Internet website at **http://www.cmu.edu/**

An Innovative Technology Summary Report (ITSR) for this innovative technology can be found at
http://apps.em.doe.gov/ost/pubs/itsrs/itsr148.pdf